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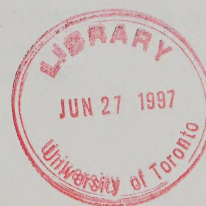
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AGRICULTURAL SOIL CONSERVATION:
FEDERAL POLICY

**AGRICULTURAL SOIL CONSERVATION:
FEDERAL POLICY**

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Science and Technology Division

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AGRICULTURAL SOIL CONSERVATION: FEDERAL POLICY*

ISSUE DEFINITION

Soil conservation is of growing interest to many Canadians. This interest stems not only from a sense that soil conservation is a "motherhood" issue, but also, and most importantly, from the realization that soil degradation is very costly. Agriculture Canada estimates that annual on-farm soil degradation costs are \$1.3 billion and could reach over \$2 billion by the end of the century. Contributors are wind and water erosion, salinity, acidity, compaction and organic matter loss. Off-farm costs due to siltation of waterways, chemical leaching, deposition and clean-up costs are close to \$100 million annually for Ontario alone. Although soil degradation has persisted over this century, only relatively recently have farmers and government come to realize the interdependence of a profitable agricultural economy and maintenance of soil quality. To reverse present levels of soil degradation due to inappropriate management practices and natural causes will require from farmers, government and the public a major long-term commitment that is only just underway.

BACKGROUND AND ANALYSIS

A. The Historical Legacy

Canada was founded on the bounty of its natural resources. Since the earliest colonial settlements, agriculture has been a major force in the development of the nation. Although the land suitable for agriculture is only 7% of Canada's total land mass, this represents 65 million

* The original version of this Current Issue Review was published in February 1987; the paper has been regularly updated since that time.

hectares. As pointed out by Dumanski *et al.*, in the early years in eastern Canada, the climate and the type of activity undertaken were conducive to good soil management and improving soil fertility. Soil degradation first became a serious problem in the prairie provinces where "vast areas of native grasslands were plowed without regard for soil stability or cropping."

Survival rather than conservation was often foremost in the minds of settlers. New farmers, learning by trial and error, took a great toll of the land. By the time the government took action on soil conservation many areas had been seriously affected through ignorance or mismanagement.

As early as 1909, the Canadian Parliament passed legislation to establish the Commission on Conservation to identify conservation problems. It saw its mandate as similar to that of the North American Conservation Conference held in Washington earlier in that year. The Chairman of the Commission, Clifford Sifton, quoted the principles established by that conference to the House of Commons when the Commission on Conservation's first report was tabled.

We recognize as natural resources all materials available for the use of man as means of life and welfare, including those on the surface of the earth, like the soil and the waters; those below the surface, like the minerals; and those above the surface, like the forests. We agree that these resources should be developed, used and conserved for the future, in the interests of mankind, whose rights and duties to guard and control the natural sources of life and welfare are inherent, perpetual and infeasible. We agree that those resources which are necessities of life should be regarded as public utilities, that their ownership entails specific duties to the public and that, as far as possible, effective measures should be adopted to guard against monopoly.

The Commission did not concern itself with soils to any great extent, dwelling primarily on forest, water and mineral management. It would appear that soil degradation resulting from western agricultural practices went unnoticed even though, within its 10-year lifespan, the Commission did make recommendations to eastern and central Canadian farmers on crop rotations, wise use of barnyard manure and control of runoff and flooding. In addition to encouraging the work of the federal experimental farms under Dr. W. Saunders, the Commission recommended the

provision of grants and subsidies to encourage the provinces to begin their own conservation programs and to develop démonstration farms.

As the population in western Canada grew, the problem experienced by the settlers became apparent. Again, to quote from Dumanski *et al.*:

The largely random, undirected settlement that characterized the prairie region at the turn of the century began to manifest itself as massive despair by the early 1920s. Farmers, most using European, eastern Canadian, or American technologies, found themselves at a disadvantage in coping with the arid land on the prairies. Dreams of quick riches, fostered by 'free' land, quickly turned into the realities of drought, grasshoppers, rust, wind erosion, and mortgage foreclosures.

Thus began one of the great mass migrations in Canadian history. People simply abandoned their farmsteads, packed what they could into wagons, and moved to more humid regions of the prairies or back from whence they had come. By the late 1920s more than 10,000 abandoned farmsteads were identified in southeastern Alberta alone.

A research station was established at Swift Current, Saskatchewan in 1922 to develop new techniques to permit farming in the "dust bowl." This region was set back again by the prolonged drought of the 1930s and the economic depression. The Prairie Farm Rehabilitation Administration (PFRA) was established in 1935 as a temporary agency to handle drought and soil erosion problems in the prairie region. Up to 1940, when PFRA's mandate became permanent, it devoted all its energies to conservation projects. As the drought and the depression came to an end, PFRA turned away from soil conservation towards engineering and water projects. By the mid-1970s, when PFRA found itself under the jurisdiction of the Department of Regional Economic Expansion, it was specializing in large-scale water works.

Meanwhile, another federal government contribution to conservation had been the *Farm Improvement Loans Act* of March 1945 which provided short and medium term credit for land improvement and development, including the construction of erosion prevention structures. Amendments to this legislation were introduced in June 1987 to encourage diversification and

marketing ingenuity, and to raise the borrowing limit. So far, such credit has seldom been used for conservation purposes.

The major federal conservation project in eastern Canada was undertaken under the *Maritime Marshland Rehabilitation Act* of 1948. By 1951, 99 dykeland rehabilitation projects to prevent erosion and/or to reclaim land from the sea were underway or had been completed.

Having survived the drought in the west and the depression across the country, Canadian agriculture entered a phase of expansion and higher productivity. For many farmers, and certainly for the public at large, soil conservation issues were no longer a serious concern. Meeting the production and shipping demands of the new markets opened up by the Second World War became the issue.

New technological developments in fertilizer and pesticides and new seed varieties permitted the production of high quality, high yielding cross grains in the west and hybrid corn in the east. Synthetic production of nitrogen fertilizers came on-stream at a cost and in supply which made them readily available. Farm operators became less dependent on legumes and grasses as rotation crops and on farmyard manure as a source of nitrogen. The idea that structure-depleting crops such as corn and soybeans needed to be rotated with soil-improving crops, such as grasses and legumes, was suddenly outmoded. These factors forced changes in farming techniques by encouraging increased productivity and crop specialization. Monoculture, namely the cash crops system, took over. One consequence was that, as the capitalization and operating costs of farms became greater, more inputs were required to produce yet higher yields of lucrative crops on larger land bases, so that many farmers were locked into specific types of farming operations. Also the probability of soil degradation increased as new crops were planted in the same fields year after year and marginal lands were plowed and cultivated for the resulting revenue. For most farmers, though, technology and relatively good commodity prices appeared to offset any effect or cost of soil degradation.

With the return to peacetime activity after World War II, there was a brief flourishing of interest in soil conservation. In 1951, a professor at the Ontario Agricultural College and an international expert on conservation, O.M. McKonkey published *Conservation in Canada*. In 1952 the National Committee on Soil Conservation was established with a mandate to

"present information on the nature and extent of what work is actually being done in Canada to promote soil conservation." At that time, erosion was measured in terms of productivity loss rather than by the dollar value lost, which is the present standard of measurement. While the Committee did carry out its mandate, the emphasis on increasing production apparently overshadowed the committee's work. Moreover, there continued to be little practical information available for the interested producer. When prices did take a downturn in the early 1960s and again in the early 1970s, farmers by and large were no longer conscious of the problems associated with soil degradation.

This was not the case among committed farmers, research scientists and some policy makers. The Senate Committee on Land Use was established in 1957 and its report in 1963 identified soil fertility and erosion problems. At the Resources for Tomorrow Conference held in 1961, soil problems and their potential impact were recognized. The Conference Report also stated that there were serious gaps in available scientific information on soil degradation. In the same period, Alberta passed its *Soil Conservation Act*, 1962, and Saskatchewan its *Soil Drifting Control Act*, 1965. Neither piece of legislation appears to have been enforced to any great extent nor to have had a significant impact on soil conservation. Productivity and profit remained the primary concerns of most farmers and generally favourable weather conditions enabled many of them to carry on activities without great concern for the land resource.

B. Recent Growth of Public Awareness

Through the 1960s into the 1980s, the technological revolution diminished concerns over soil quality reminiscent of the dust bowl of the 1930s except in a few who had long memories or had made the subject their life's work. During this period, however, the conservation issue arose in another context, that of the growing concern over pollution and urban expansion. The effect of urban sprawl on good quality farmland and the recognition of the fact that most urban centres are built on such land helped to sensitize the public to the need for conservation. The concern about pollution included the effect of chemicals on the environment; in eastern Canada the major concern was water pollution. Significant in the development of public awareness of this

problem was the work on the Great Lakes, culminating in PLUARG,* and allied studies. Proof that large numbers of dead fish and dying lakes were caused by chemical loading by industry and agriculture brought agricultural chemical use to public attention and prompted preventative work. This meant primarily the prevention of erosion.

In the early 1980s yet another downturn in commodity prices, this time accompanied by drought in 1977 and 1980 and dry years thereafter, increased awareness of erosion and salinity problems in western Canada.

All these events culminated in a resurgence of concern about soil degradation. W.W. Pettapiece at the Alberta Conference on Agricultural Land, Our Disappearing Heritage, held in 1983, stated that there must be a change in the historical view of agriculture as a free enterprise occupation in which anything economically feasible must be right. It had to be recognized that incorporating ethical principles into land use decisions would result in better use of the land resource.

Dr. Pettapiece also pointed out that the most serious problem was the lack of data to combat soil degradation. While some work related to production enhancement had been taking place, most of this was in plot trials or laboratories; it was estimated in 1983 that Agriculture Canada was spending only \$188,000 and 4.4 professional person years on direct in-house research on soil conservation. Though not starting from scratch, Canada had a long way to go before it would possess adequate conservation information suitable for on-farm use.

The realization that technology could not overcome all the problems of farmers and that high costs and low returns necessitated increased efficiency, promoted interest in soil conservation techniques within government as well as among farmers. After years of little concern for land degradation, PFRA created a Soil and Water Conservation branch in 1981. This branch published *Land Degradation and Soil Conservation Issues on the Canadian Prairies - An Overview* in November 1982 and an expanded version in December 1983. The Canadian Federation of Agriculture held a soil conservation workshop in December 1982 and formed the National Action Committee on Soil Conservation the following year. December 1982 saw the publication of

* International Reference Group on Pollution of the Great Lakes from Land Use Activities.

Cropland Soil Erosion - Estimated Cost to Agriculture in Ontario by the Ontario Ministry of Agriculture and Food. This publication estimated that, for southern Ontario alone, soil losses ranged from \$68 million to \$122 million per year.

In 1983 a major article on soil degradation, "Stresses on Land Under Intensive Agricultural Use," by D.R. Coote, appeared in the Environment Canada publication *Stress on Land*. This article was the first attempt to translate the material available for those working in the field into a document for the general public. The Senate Agriculture, Fisheries and Forestry Committee's Report, *Soil at Risk*, released in 1984, was the next such attempt. In the same year the Agricultural Institute of Canada published *Will the Bounty End?* by Garry Fairbairn. This dealt with land use as well as soil degradation issues. Agriculture Canada published *Agricultural Soil and Water Reserves in Canada: Situation and Outlook* in 1985 and the Science Council of Canada released a statement entitled *A Growing Concern: Soil Degradation in Canada* in September 1986. These publications and various media events served to raise public awareness of the seriousness of soil degradation in this country.

In the fall of 1986 a number of interested individuals and organizations, including the Canadian Federation of Agriculture, the United Grain Growers, Ducks Unlimited, the Agricultural Institute of Canada and Senator H.O. Sparrow, Chairman of the Senate Committee which had published *Soil at Risk*, joined together to form a new national organization concerned with soil conservation in Canada. Soil Conservation Canada was founded in May 1987 with the basic objectives of fostering greater awareness of the problem of soil degradation and encouraging research and other ways of promoting conservation. It also has the mandate to monitor government conservation efforts. The organization appointed an interim Executive Director and a Board of Directors. The institute issued its first newsletter, *The Protector*, in the fall of 1987.

Provincial departments have also responded within financial and personnel restraints with various programs. Examples are Farming for the Future in Alberta and Save Our Soils in Saskatchewan. In Ontario a program called Tillage 2000 aimed at providing additional soil conservation information and technical advice. Another Ontario program was the three-year, \$40-million Land Stewardship Program for first-time adoption of conservation practices on Ontario farmland. This program was expanded in 1990 as part of the Canada-Ontario Soil and Water

Accord. Over four years, \$38 million has been provided for technology transfer. In April 1992, a two-year federal-provincial program was announced to assist Ontario producers who follow environmentally sustainable practices. The federal portion of the Land Management Assistance Program will be \$15 million. Prince Edward Island is concentrating on hedgerow renewal, subsurface drainage and expanded use of limestone. Except for the Atlantic Provinces, all provinces have enacted legislation addressing soil conservation problems, though not necessarily geared to encouraging preventive measures.

C. Federal Initiatives

Although the federal government had endorsed both the Strategy for Land Resource Research and the World Conservation Strategy in 1981, it made no firm commitments to soil conservation as a policy issue until the Economic and Regional Development Agreements (ERDAs) came up for agreement in 1984-85. At that time, soil and water conservation components were written into ERDAs in Manitoba, Prince Edward Island, British Columbia, Alberta and Saskatchewan. The soil and water components by and large did not include large amounts of money but demonstrated federal commitment to working on the problem.

This was evident in late 1985 when soil conservation was put on the agenda of the First Ministers' Conference and a task force on soil conservation was struck. This task force, headed by Dr. Harry Hill, director of PFRA, reported back to the First Ministers and the findings were included in the National Agriculture Strategy issued in November 1986. The Strategy confirmed that federal and provincial governments understood their jurisdictional responsibilities and believed that a joint commitment to long-range planning for the conservation of the soil was required for the future of agriculture and the food sector in Canada. Dr. Hill was designated Chairman of the Agriculture Canada Soil and Water Conservation Strategy Committee. He met with provincial Deputy Ministers of Agriculture in spring 1987 to discuss the implementation of the National Strategy recommendations with the goal of jointly working towards soil conservation in their respective provinces by means of bilateral accords.

This process was set in motion by Prime Minister Mulroney's announcement at the December 1987 Canadian Agricultural Outlook Conference that \$75 million would be available from the federal government over three years on a matched basis for initiatives throughout Canada in soil conservation. Dr. Hill was appointed to head the new program, the National Soil Conservation Program, which involved negotiating federal and provincial soil and water accords to foster demonstrations, research, technical and financial assistance, monitoring and public awareness. Agreements have now been reached with Yukon (\$100,000), B.C. (\$5 million), Alberta (\$34.8 million), Saskatchewan (\$54 million), Manitoba (\$18 million), Ontario (\$22.2 million), Quebec (\$21.2 million), Nova Scotia (\$1 million), New Brunswick (\$2.4 million) and P.E.I. (\$1.8 million).

Part of the overall conservation plans of the new group included taking over a conservation reserve program, the Permanent Cover Program, first proposed by the PFRA in the fall of 1987. The PFRA identified 14 million acres of marginal land across the prairies that should be permanently protected by a covering of grass, forage or trees. Although the PFRA was still involved, it was the National Soil Conservation Program that became responsible in 1989 for implementing this program, which cost the federal government about \$20 million. In April 1991, Permanent Cover II, a three-year extension, broadened the scope of the program to reduce the amount of marginal land under production.

Unlike the U.S. mandatory set-aside program, where a farmer has to take a portion of his land out of production to qualify for government support programs, financial assistance is to be allocated depending on the expense of conversion to forage crops and the time-frame of the commitment. There are three options available: (1) a one-time assistance payment of \$20-an-acre for land-owners to convert to perennial forage marginal lands that are now sown to annual crops; (2) the option for landowners to tender a bid to plant and retain cover in marginal lands for 25 years; and (3) the provision of funds to help groups convert marginal lands to permanent cover.

The Federal-Provincial Soil and Water Accords are now seen as a model to be broadened to embrace all aspects of environmentally sustainable agriculture. This was a principal recommendation of the Federal-Provincial Environmental Sustainability Committee when it reported to Ministers of Agriculture on 30 June 1990.

In August 1990, federal and provincial Ministers of Agriculture adopted a framework for action on environmental sustainability in the agri-food sector. The \$150-million Green Plan agriculture initiative of February 1992 was, over a six-year period, to be the means to halt soil degradation, develop more shelterbelts, and manage pollution and other use conflicts.

Environmental sustainability is one of the pillars of federal agricultural reform underway since 1989. The Science Council examined its technology aspects in a report entitled "Sustainable Agriculture: The Research Challenge." The Standing Committee on Agriculture also made recommendations to the House of Commons on the subject of sustainable agriculture in its May 1992 report entitled "The Path To Sustainable Agriculture." One of the Committee's prime interests was the role of farming practices in the health of the resource base.

D. The Resource Base

The recurring pattern of dryness over recent years is prompting some observers to wonder whether the prairies are experiencing a climate change; however, evidence of historical variability leaves this observation unconfirmed. Even so, the severity of the situation led the federal government in May 1988 to extend an additional \$12 million in aid to help prairie farmers develop new water supplies. In June, a \$153 million federal-provincial drought program for prairie livestock producers was announced. Some of this assistance was to help western Canada producers to expand their production of forage crops so as to keep topsoil in place. This money was in addition to the \$95 million in assistance already provided to these producers during the Conservative regime. Another \$850 million was earmarked in November 1988 as part of special drought assistance for crop producers. Previous drought payments to these crop producers had reached just under \$150 million.

Dr. Hill warned during National Soil Conservation Week in April 1988 that soil degradation was costing Canadian farmers \$1 billion every year in lost farm income. In spring 1988, wind erosion from drought stripped topsoil from many areas of southern Saskatchewan. This was expected to increase the 50,000 square miles already identified as lacking sufficient cover to protect it from erosion. This total included about 96% of all summer-fallow fields and 18% of

fields worked down after the harvest of 1987. Farmers were advised to maintain cover by keeping cultivation to a minimum and leaving stubble standing. The lack of plant growth in the summer of 1988 left no stubble to hold soil in place over the winter, so that there was the potential for further soil degradation by spring 1989.

PFRA had warned in its 1988 crop residue survey that farmers pay inadequate attention to crop residue management. Crop residues are considered the cheapest and most effective means of protecting the soil against both wind and water erosion. At least average yields are required to produce sufficient residue to be worthwhile.

Another report released by PFRA in August 1990 identified poorly conceived government policies as contributing to the destruction of vast tracts of Saskatchewan land. It called for a comprehensive land use policy to encourage sustainable development, education on management practices and compensation for changing these practices.

Farmers in the southwest of Saskatchewan have come to realize that uncovered soil, for example from summer fallowing, can lead to soil degradation. However, controversy remains about the role summer fallow plays in soil degradation since summer fallow is thought to help weed control and to increase moisture in the soil for subsequent cultivation. In 1986 some 8.3 million hectares of prairie farmland were in summerfallow, down 22% from its peak use in the 1970s. Almost all summer fallow in Canada is found in this region. There are still about 17 million acres of fallow land in Saskatchewan alone. Nevertheless, farmers are becoming aware of the advantages of reduced tillage and planting of shelterbelts. Reorienting fields so they face into, rather than across, prevailing winds is also being tried. In Alberta, a 1991 survey showed that farmers are reducing tillage and increasing crop rotation practices. Farmers alone, however, cannot be expected to undertake new practices which may not be perceived to be beneficial.

In the prairies, the period between mid-November and mid-April remains critical because of the potential for soil erosion should snow cover be inadequate. Crop residue cover in southern Saskatchewan and Manitoba, west central Saskatchewan, and some areas of southern Alberta was considered insufficient to prevent erosion over the winter of 1988. Southern Saskatchewan experienced three wind erosion incidents the previous fall which had exacerbated the poor cover situation in that region. Precipitation was above normal for southwestern Saskatchewan

and northern Manitoba in January 1989. Still dry, however, was a strip across central Saskatchewan.

Rains in the fall of 1989 improved surface soil conditions across the prairies. It was estimated, however, that it would take at least two years of good runoff to recharge groundwater supplies to normal levels. South and west-central Saskatchewan were at about half of normal precipitation in 1990. Late fall rains in 1991 recharged summerfallow fields across Saskatchewan.

Through the winter of 1991, farms north and east of Saskatoon received very good snow cover, with enough moisture to carry fields through planting. South and west of Saskatoon, dry surface conditions predominated into the spring of 1992. Conditions were also poor in southern Alberta and northeastern B.C. Dry conditions continued in the north of the three prairie provinces, while too much rain spoiled crops in the south. Late-maturing crops were devastated by a frost in late August. Crop quality was consequently poor, with feed wheat accounting for 39% of 1992 wheat grades.

A preliminary investigation by PFRA of 1992 winter conditions indicated below-normal runoff and soil moisture levels in northern Alberta and Saskatchewan, and parts of southeastern and southwestern Manitoba. PFRA recommended a need for soil conservation measures in the spring of 1993. After a dry spring had stunted hay growth, the rains began in mid June and continued into August, contributing to low yields and poor quality hay. Northwestern Manitoba was particularly hard hit in early July by floods.

Wet and cold conditions in the spring of 1996 delayed seeding across the country. Northern Alberta experienced flooding in June 1996. Weather conditions were variable across the prairies with the result that crop yields and quality varied widely. Consequently, whereas Manitoba's 1996 harvest was disappointing, Saskatchewan expects a bumper crop, provided it can mature and be taken before the first frost.

It is clear from the foregoing that in the 1980s a number of measures encouraged voluntary action to combat soil and water degradation. The increase in conservation farming methods over the past 10 years is evidently improving soil quality in some regions of the country, according to a study entitled *The Health of our Soils*, published by Agriculture and Agri-Food Canada in July 1995. The study evaluated soil quality using the following criteria: soil structure,

soil salinity, wind and water erosion and agrichemicals in groundwater; it reported that "levels of soil organic matter have increased in some areas, the risk of erosion has decreased nearly everywhere in the country, and the risk of salinization has decreased in the Prairie Provinces."

The study suggested that:

- R Soil health will continue to decline in areas of intensive cropping and marginal land where conservation farming methods are not used.
- R Soil health is holding steady or improving in regions where conservation practices have been tailored to local problems of soil degradation.
- R Declines in soil health occur rapidly, often most dramatically in the first 10 years following conversion of virgin land to agriculture; improvements in soil health take place slowly and cost more.

The study emphasized that soil degradation is largely the result of inappropriate farming practices. The success of techniques to protect soils will depend on how quickly these are adopted. The Census is now collecting data on farming techniques that will make it possible to monitor their adoption rates. Conservation tillage, for example, is already being used on one third of Canada's cultivated land. The 30% reduction in fallowed land over the past 20 years has also contributed to decreased erosion. Greater rotation of crops has helped build up soil organic matter. Because soil management is site-specific, however, the study points out that techniques need to be tailored at the farm level. The choice of crops and inputs is also important to soil health and must be integrated in concert with conservation farming practices.

The study concluded that traditional agricultural policy, which focused on high production and saw agriculture as a closed system, has become inappropriate. It suggested that the concept of sustainable agriculture has created a need for a new policy "that acknowledges the environmental effects of agriculture and promotes resource conservation along with productivity." The new policy should apply the findings of ongoing research and monitoring programs, support producers during their transition to conservation farming systems, and direct programs to problem areas and problem farmers.

CHRONOLOGY

- 1910 - Clifford Sifton chaired Commission on Conservation set up to examine the use of Canadian natural resources.
- 1920s - First incidence of major soil degradation on the Canadian Prairies identified.
- 1935 - Prairie Farm Rehabilitation Administration (PFRA) created.
- 1945 - *Farm Improvement Loans Act* (FILA) came into force, providing some assistance for conservation work.
- 1948 - *Maritime Marshland Rehabilitation Act* was passed.
- 1952 - National Committee on Soil Conservation formed.
- 1958 - Senate Committee on Land Use established.
- 1961 - Resources for Tomorrow Conference identified soil degradation problems.
- 1981 - PFRA created a Soil and Water Conservation Branch.
- 1982 - PFRA published *Land Degradation and Soil Conservation Issues on the Canadian Prairies - An Overview*.
- 1984 - Standing Senate Committee on Agriculture, Fisheries and Forestry issued *Soil at Risk - Canada's Eroding Future*.
- 1985 - First Ministers established a federal-provincial task force on soil conservation in Canada.
- 1986 - A week in April was designated as National Soil Conservation Week.
- 1986 - National Agricultural Strategy, including a commitment to soil conservation, was developed and issued by First Ministers.
- 1986 - Science Council of Canada issued *A Growing Concern: Soil Degradation in Canada*.
- 1987 - Soil Conservation Canada established.
- 1987 - Amendments to *FILA* introduced.

- 1989-1990 - Federal-provincial agreements on soil conservation, totalling \$150 million, were reached.
- May 1992 - Standing Committee on Agriculture issued "The Path to Sustainable Agriculture."
- July 1992 - Science Council of Canada issued "Sustainable Agriculture: The Research Challenge."
- July 1995 - Agriculture and Agri-food Canada published *The Health of our Soils: Toward Sustainable Agriculture in Canada*.

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